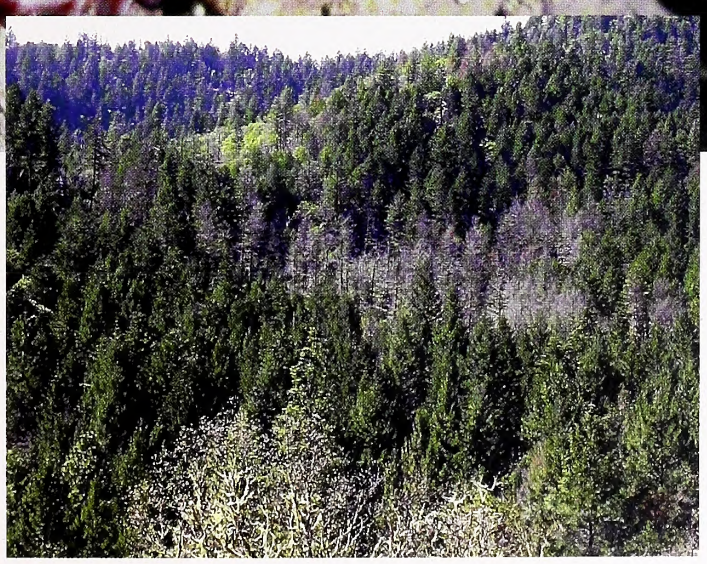
Managing for Forest Health

Insects and Disease



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Managing for Forest Health

The history of fire in southwest Oregon

Historically, fires occurred more frequently and with less intensity than they do today. As southwest Oregon became colonized by Euro-American settlers, many fires were suppressed and by 1902, the active suppression of all fires became policy. Forests growing in the absence of natural fire began to develop differently than those which developed prior to settlement.

As a result of fire suppression, forests that once burned regularly are now changing and many of the ecological processes that kept them healthy and resilient have been altered. Many of our local forests are becoming stressed, making them susceptible to insect infestations, disease, and catastrophic fire.

In addition, changes to the biological diversity of the region have occurred as ponderosa and sugar pine trees are out competed by Douglas-fir. Open pine forest habitats are rapidly declining in abundance throughout southwest Oregon.

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Insects and Disease

Natural roles vs. unnatural conditions

The historic role of fire

In the natural environment, ecological process such as wind, insects, disease, drought, and lightning-caused fires regularly sculpted the native forests. Here in southwest Oregon, frequent lightning-sparked fires were the primary factor in shaping the forest. The use of fire by Native Americans to enhance resources important to them, such as the production of preferred plants and animals also played a role in shaping the landscape.

In low to mid elevation forest stands, these low intensity fires served as a thinning mechanism and regulated the forest density. These forests consisted of fewer, faster growing trees than in the younger forests we see today. Trees that grow with less competition tend to be taller, more vigorous, and resistant to insects and disease. In addition, the historical forests had more structural diversity.

Low intensity fire prescribed to mimic the natural role in forest ecosystems.

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Changes in forest conditions with the onset of fire exclusion

Forests on public lands have changed significantly in the last 100 years. After years of fire exclusion, most forests in southwest Oregon are developing differently than prior to Euro-American settlement. Not only are the forests becoming increasingly dense, habitats for many important species are rapidly diminishing. Many forests have become stressed, rendering them vulnerable to insect infestations, disease, and catastrophic fire.

Insects and disease are a natural part of forest ecosystems. They contribute to the development of openings, species succession and increase in wildlife habitat. In conjunction with wildfire, they assist in the creation and development of structurally complex and dynamic forests over time. Unfortunately, with the exclusion of fire, forests have changed and insects and disease have become more prevalent causing wide-spread mortality.

After years of fire exclusion, southwest Oregon forests are becoming increasingly dense.

When fire is removed from the ecosystem, more slow growing trees are produced. The increased competition for resource reduces tree vigor and increases their susceptibility to insects and disease. Pine trees that require direct sunlight and thrive in more open fire prone environments are out competed by shade tolerant species such as Douglas-fir.

Insects and Disease

Insects and disease, a natural part of forest ecosystems, contribute to habitat diversity.

Large, old trees are placed at risk to insect caused mortality when crowded by many young, small trees.

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Competition leads to stress and vulnerability

Before the advent of fire exclusion, most forests consisted of fewer trees in fairly open stands. The result was individual large trees that grew at faster rates. With increased competition, growth slows resulting in trees that are less vigorous and less capable of resisting insects.

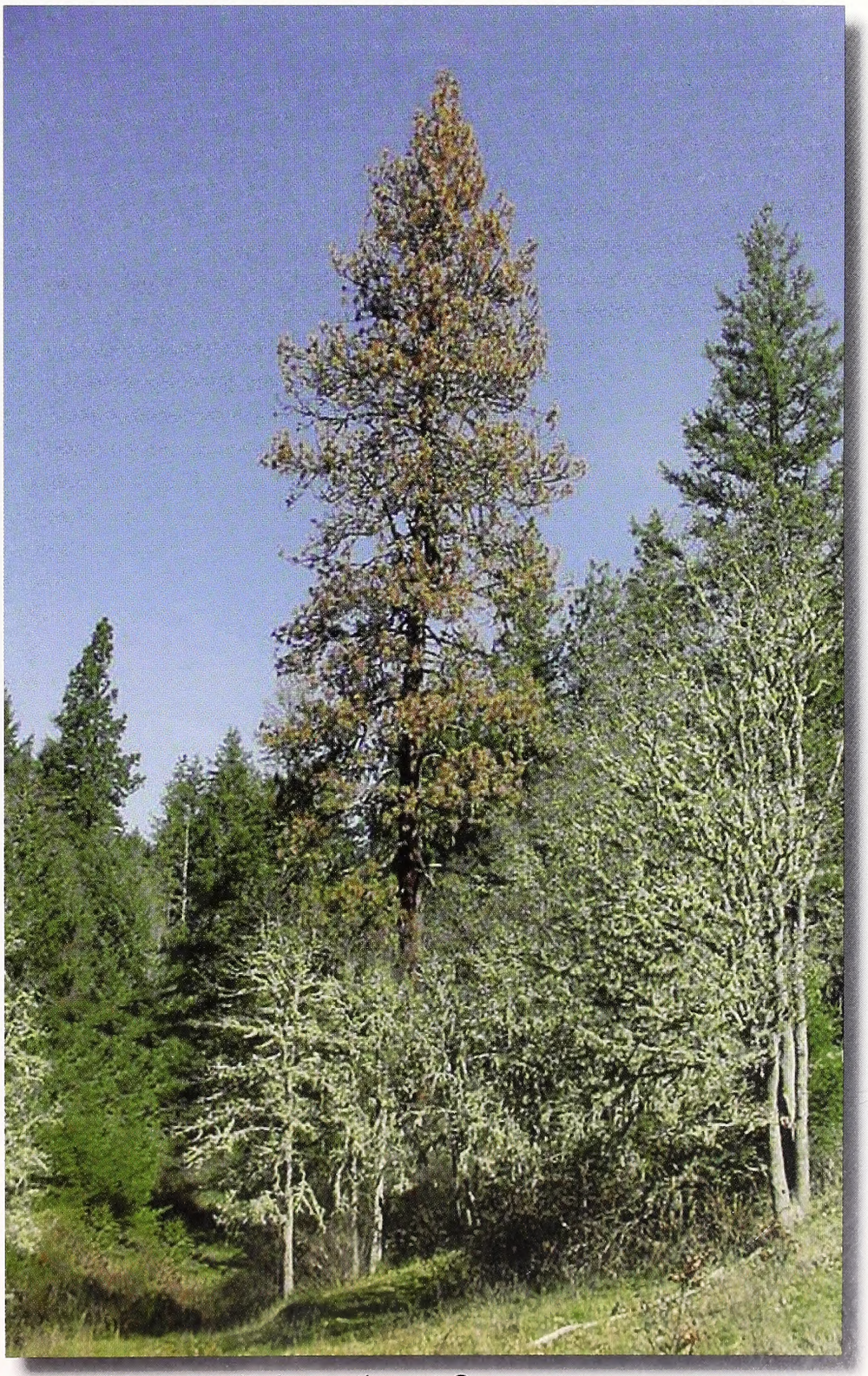
Small trees growing under larger older trees in the absence of fire result in forest stand densities far in excess of historical conditions. Many young small trees growing under older larger trees contribute to stand densities that are not sustainable. These high stocking levels place the large trees in direct competition with the younger ones.

The rings on this tree show how growth slows when the tree has to compete for water and nutrients. Each segment on the blue line above represents 10 years of growth.

Insects and Disease

When drought conditions limit water availability large trees are stressed. Stress creates favorable situations for insects and disease to affect trees no longer capable of warding off attacks due to their weakened state.

The result of these insect and disease infestations is apparent as you travel throughout the West. Where once green forests stood, an ever increasing number of trees are turning red and then gray as they sicken and die. These decaying trees contribute to the tinderbox conditions that threaten many of our forests.



Large pine mortality in southwest Oregon.

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Tree resistance to bark beetle attacks

Bark beetles rarely kill healthy vigorous trees; they are most successful on trees weakened by competition for water and disease. While bark beetles were present and killed some trees historically, frequent low intensity fires that regulated stand densities prevented major insect infestation.

Large old pine trees are being lost to bark beetle caused mortality faster than they are being replaced.

The relationship between the level of competition among trees and the stand's resistance to disease and insects has been documented for many tree species. For example, an outbreak of western pine beetle is inevitable when lodgepole pine stands become so dense that tree growth and vigor are reduced below a certain threshold. If thinning reduces stand densities to maintain or restore tree vigor and growth, the stand remains resistant to the western pine beetle attacks. This same correlation has been shown for Douglas-fir and ponderosa pine stands.

Trees resist the invasion of bark beetles and disease spores by forcefully expelling them with pitch, which is extruded under pressure from vessels beneath the bark. The success of this defense mechanism is directly related to the amount and pressure of sap in the tree, termed oleoresin pressure. Oleoresin pressure is controlled by water availability. Trees growing in a crowded

Bark beetle, also known as Western pine beetle, emerging from a hole in pine bark.

stand compete for water and nutrients. As they grow larger, there becomes less and less available water reducing its oleoresin pressure which, in turn, lowers its resistance to insects and diseases.

In addition, insects, particularly bark beetles, chemically sense when trees are weakened. These newly attracted insects compound the trees' problems because multiple, simultaneous insect attacks the tree further weakening it. Trees that are successfully colonized by insects and disease create a host population available to infest nearby trees. If there is an abundance of stress weakened trees in the surrounding area, an epidemic can occur.

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Diseases

In stressed conditions, diseases are common as well. In the absence of fire and increased competition, small trees are susceptible to root rots and other diseases. Root rots in particular, infect weakened trees. These affected trees contribute to fuels that accumulate on the forest floor further increasing chances of stand replacing fire behavior. Trees weakened by root rots and disease also become more susceptible to insect attack.

Douglas-fir mortality in southwest Oregon. Tree mortality increases the risk of fire to a rural community.

Insects and Disease

Bark beetles (above) are the initial invaders. Long horned wood boring beetles (both beetles shown below) infest trees weakened by bark beetles and the fungus they introduce.

Bark beetles

Throughout southwest Oregon, bark beetles are the primary forest health concern in overly dense pine and Douglas-fir forests. Unfortunately, with the exclusion of fire and the increase in forest densities, bark beetle activity has been on the increase.

At present in southwest Oregon and throughout the west, overly dense forests further stressed by drought provide ideal conditions for a surge in bark beetle activity. Large pine trees are being lost to beetles at a faster rate than they are being replaced.

Bark beetles, like many other insects, are attracted to weakening trees by the smell of their changing monoterpene:nopinene ($C_{10}H_{16}$) concentrations as a result of increasing stress. When the beetles find a vulnerable tree they quickly move in colonizing it.

Many bark beetles carry fungal spores in a pouch on the side of their shell (elytra). They then plant these spores beneath the bark in the tunnels that they construct to deposit their eggs. As the fungal spores germinate and grow the fungus provides a food source for the hatching insect pupa and larva. However, as the fungus colonizes the tree, it clogs the vessels (xylem) that transport water up the tree, causing it to sicken and die. The dying tree then becomes a source of insects that emerge, depart and seek other trees to colonize and reproduce.

After the tree is infected with the fungus and in weakened condition, it can become the host of other insects including long horned wood boring beetles. These beetles contribute to the rapid decay of the wood.

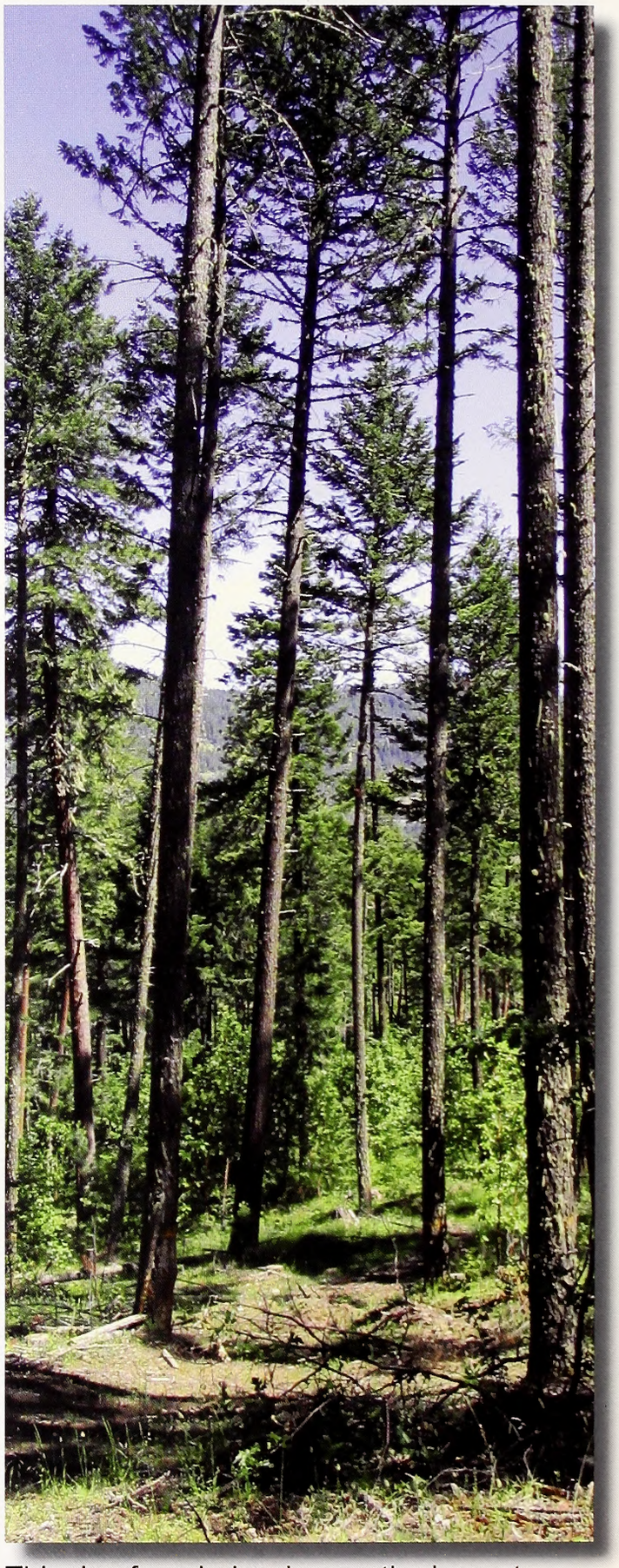
Managing for Forest Health

Management options

It's clear that the high densities of small trees present in many of our forests do not create favorable conditions for growth of large trees or maintenance of fire tolerant pine species. However, there are actions that we can take that can improve forest health. When used appropriately, active management practices, such as harvesting, thinning, and prescribed fire, can be used to mimic important natural disturbances.

Projects are designed by land managers to thin forest stands in order to improve tree vigor by reducing stand densities. Thinning reduces the competition for water, growing space, and nutrients. Vigorously growing trees can better withstand drought conditions and insect attacks.

Thinning treatment guidelines often focus on "thinning from below"; meaning that the biggest and healthiest trees are left to grow and the smaller and often stressed trees are removed. Thinning guidelines are tailored for various site conditions and stand types. The result is forests with fewer, but larger trees capable of growing freely, improving their ability to capture sunlight and water for long term growth and survival.



Thinning from below leaves the largest, healthiest trees to grow.

Insects and Disease

Young forest restoration

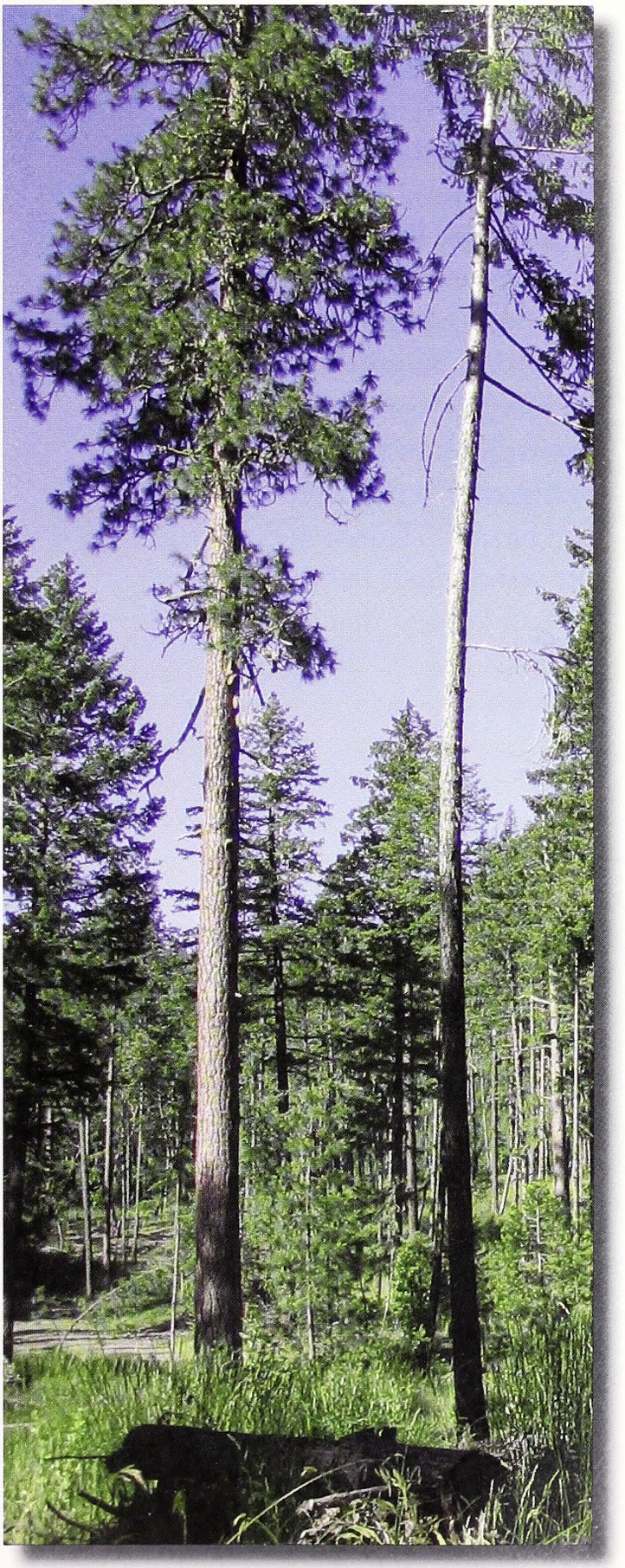
Stands of young trees are the forests of the future. In the absence of natural fire and without treatment, most stands will not develop into desirable forest conditions. Many are becoming homogeneous stands of overly dense, fire prone Douglas-fir which curtails the development of species and habitat diversity.

Treatments are designed for young forest stand restoration to:

- lessen potential resource damage when fire occurs,
- reduce "ladder fuels" in the understory to prevent the spread of fire into the tree tops, thereby reducing the potential for an intensive crown fire,
- promote greater species and habitat diversity, and
- improve tree resistance to disease and insects.

Pine species restoration

Ponderosa pine is a valuable component in most southwest Oregon stands because it is well suited for a dry, hot climate. Many forests are losing ponderosa pine as a result of over-crowding by Douglas-fir. Small openings called "group selections", varying in size from ¼ to ¾ acres, are being created to encourage sun-loving ponderosa pine initiation and growth. Also, selective thinning is used to reduce densities in pine forests to restore the vigor and resiliency of large pine trees.



Selective thinning favors large pine trees to maintain and restore fire resilient species.

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Fuel hazard reduction

As communities at risk from wildfire are identified, agencies review the actions necessary to reduce fuel hazards and improve overall forest health. Generally, treatment techniques used to improve tree vigor and forest health are also effective in reducing fire hazard. Thinning conifer stands from below reduces fuel ladders that allow fire to spread to the canopies of trees. Thinning treatments are followed by additional fuels reduction treatments that involve cutting, piling, and burning of slash created from forest thinning. This work also includes treating the natural build up of dead and downed wood on the forest floor and understory vegetation (shrubs and small trees 6 to 8 feet tall).

Slashbuster thinning dense understory shrubs.

Fuels reduction treatments also occur in oak woodlands and shrublands where vegetation is thinned to favor the maintenance of native species. Thinning can be accomplished by hand cutting and piling, or the use of a machine called the slashbuster. The slashbuster is a large machine, essentially a huge weed whacker that chops slash and other unwanted vegetation into small pieces and disperses the woody debris across the forest floor.

Right side of photo: Unmanaged young forest stand.
Left side of photo: Young forest stand thinned from below to reduce stand density.

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Reintroducing fire

Prescribed fire, the purposeful and controlled burning of vegetation, is one tool managers have to help maintain a healthy forest. However, dense vegetation and a lot of dead and down wood can make it challenging to apply prescribed fire. Heavy fuel loads increase the intensity of fire. If fire intensity is too high it can have damaging effects on soils, protective duff layers, and desired forest stand components such as large trees.

Thinning and fuel reduction treatments designed to improve forest stand health also improves conditions for the reintroduction of fire in a safe and controlled manner. Prescribed fire is carefully applied when fuel moisture, soil moisture, and weather conditions allow for the fire to be confined to a predetermined area. By designing projects that mimic the natural role of fire across the landscape, managers can reduce fire hazard while restoring the health of forest ecosystems that evolved with fire.

Careful application of prescribed fire is used to restore fire dependent ecosystems.

The Healthy Forest Initiative and Healthy Forests Restoration Act

The Healthy Forests Initiative (HFI) was launched by the Administration in 2002 to reduce barriers to the timely removal of hazardous fuel on federal lands. Under the HFI, Departments of Agriculture and the Interior and the Council on Environmental Quality (CEQ) developed administrative and legislative measures for expediting projects designed to reduce the threat of catastrophic wildfire to America's forests and rangelands.

In 2003, Congress passed the Healthy Forests Restoration Act (HFRA) to reduce delays and remove statutory barriers for projects that reduce hazardous fuel and improve forest health in areas at risk of insect and disease epidemics. The HFRA provides a streamlined process for evaluating and approving projects located in specific areas and includes provisions to encourage meaningful public participation during the preparation of projects.

In addition to removing regulatory barriers, the HFRA provides direction for monitoring completed projects as well as for the development of research and technology transfer necessary to combat infestations of forest damaging insects and related diseases. The HFRA establishes an accelerated program to:

- Promote comprehensive and systematic information gathering on forest-damaging insects and associated diseases;
- support resource managers in the development of treatments and strategies to improve forest health; and
- Disseminate the results of the information gathering, treatments, and strategies.

The HFI and HFRA serve to aid in the implementation of the goals of the National Fire Plan and its ten-year comprehensive strategic implementation plan aimed at reducing wildfire risks. The strategic plan was adopted by federal agencies in cooperation with western governors, county commissioners, state foresters, and tribal officials.